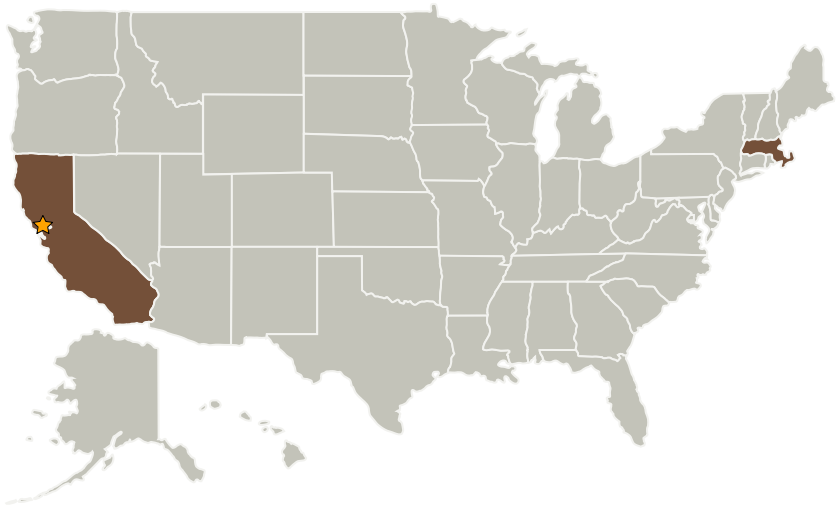
Terahertz Quantum Cascade Laser-Based Sensors for Hypersonic Flows (7275-020), Phase II

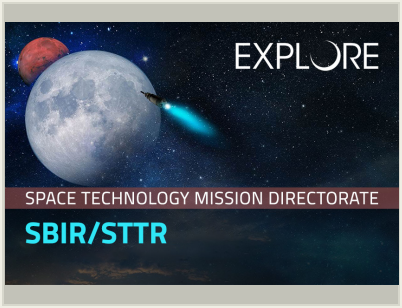
Completed Technology Project (2005 - 2007)

Project Introduction

Physical Sciences Inc. (PSI) proposes to design, build, test, and deliver to NASA a THz wavelength absorption sensor for continuous monitoring of atomic oxygen concentration in hypersonic flowfields. In a successful Phase I effort, PSI developed a THz wavelength Quantum Cascade Laser (QCL) at 63.2 microns, corresponding to a strong fine-structure transition of atomic oxygen. Using an external cavity design, we showed that the laser wavelength could be coarsely tuned to the atomic oxygen transition. Rapid and repeatable injection current tuning at this wavelength was also demonstrated. In the proposed Phase II program, the external cavity QCL design will be refined to include a wider continuous tuning range, higher laser operating temperature, and improved output power. The laser operation will be automated and integrated into a computer-controlled atomic oxygen sensor, providing continuous, real-time measurements of atomic oxygen concentration with a sensitivity of 10^13 atoms per cubic centimeter in a 10 Hz bandwidth. PSI will deliver, install, and test the sensor at the NASA Ames Aerodynamic Heating Facility, an arc-jet heated high-enthalpy flow facility.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Physical Sciences, Inc.	Supporting Organization	Industry	Andover, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.1 Field and Particle Detectors